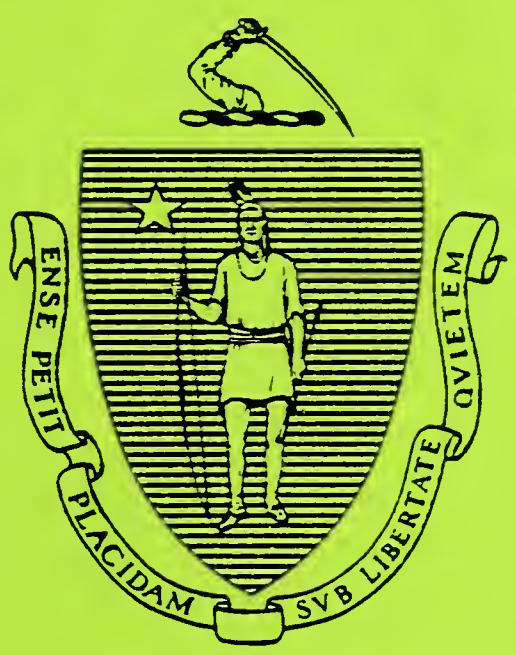
Facker 1981

1979 ANNUAL REPORT

July 1, 1978 - June 30, 1979



DIVISION OF MARINE FISHERIES

Philip G. Coates, Director

Publication #12,418-27-100-5-81-CR
Approved by John Manton, State Purchasing Agent

Table of Contents

Publication #12418-27-100-5-81-CR

Approved by John J. Manton, State Purchasing Agent

ANNUAL REPORT

MARINE FISHERIES ADVISORY COMMISSION

The Marine Fisheries Advisory Commission (MFAC) conducted seven public hearings, seven public meetings and one executive business meeting during Fiscal Year 1979. The MFAC hearings dealt with the management of sea herring and groundfish in state waters, and the prohibition of certain types of mobile fishing gear in Nantucket Sound during portions of the year. The public hearings were well attended and proponents and opponents of the issues were granted time during the hearings and within thirty days after, to present their views.

The Commission spent a great deal of time deliberating over Coastal Lobster Hardship applications and criteria. A total of 68 hardship applications were issued in 1978, and 44 have been issued in the first six months of calendar year 1979. During the year the Commissioners gave their support to the Director to allow him to promulgate emergency regulations to prevent the over-harvesting of sea herring in state waters. Commissioners Fields, Weld, and Johnson were reappointed by the out-going Governor Michael Dukakis. Department of Fisheries, Wildlife and Recreational Vehicles Commissioner Steve Chmura was welcomed by the MFAC.

The Commission also met in executive session to discuss a possible successor to Director Peterson, who announced his resignation to accept a position with the National Marine Fisheries Service.

Respectfully,

Francis Mirachi, Chairman
Robert Barlow, Vice-Chairman
Charles Fields, Clerk
Morris Johnson
Jay Lanzillo
David Ryder
Elizabeth Stromeyer
Harry Swain
Christopher Weld

REPORT OF THE DIRECTOR

Fiscal 1979 was another year of change for fisheries management. The Fisheries Conservation and Management Act of 1976 continued as the major focal point of managers and fishermen alike.

The New England Fishery Management Council struggled with the task of equitable management of the groundfish fishery. A second Council Plan was developed for sea herring. Director Peterson was elected Council Chairman in August, 1978 and served in that capacity until his resignation.

All Division projects continued. The coastal resource assessment project was expanded to supplement National Marine Fisheries Service data to give a clearer assessment picture from the shore to the edge of the Fishery Conservation Zone. Both the marketing and extension programs were expanded to provide broadened service to the Commonwealth's important commercial fishing industry.

For the first time in over 30 years, winter fishing areas on the North Shore were opened for otter and beam trawling. This regulated fishery gave needed access to coastal waters for North Shore day trawlers.

On June 30, 1979, Allen Peterson resigned as Director to accept a position as the Northeast Regional Director of the National Marine Fisheries Service. Arthur Chesmore was named as Acting Director until a permanent Director could be appointed by Commissioner Steve Chmura and confirmed by the Marine Fisheries Advisory Commission.

Fishery Council Liaison

The Liaison provided Division commentary on New England Fishery Management Council subjects to the Secretariat administration, Marine Fisheries Advisory Commission and Division personnel on a regular basis. Numerous meetings and hearings were also attended and summarizations provided to the Division staff.

The Councils drafted fishery management plans for sea herring, mackerel, squid, butterfish and ocean quahog/surf clams for which the Liaison reviewed and commented upon for the Director.

The issue of groundfish management was addressed at state, federal and Council levels. A paper written by Council and National Marine Fisheries Service staff which dealt with groundfish management was reviewed. The paper issued a "statement of the problems" in the groundfish fisheries and suggested solutions. This proposal sparked much controversy since it appeared by many to be slanted towards limited entry and suggested certificate programs as the best way to manage the groundfish fisheries.

Information was provided to the public and fishing industry by telephone, letter and personal meetings on Council Plans and regulations, state interactions with Council/Federal management regimes, and other FCMA related activities.

The first Massachusetts territorial waters regulations, in response to a Council Plan, were implemented for cod, haddock, and yellowtail flounder. This followed a series a public hearings and Division/Commission meetings. Similarly, sea herring regulations, which are yet to be implemented, were devleoped.

BUREAU OF ADMINISTRATION AND OPERATIONS

The Fiscal 1979 appropriation of $1,459,980 was administered under six accounts: Administration and Operations, Research, Sportfisheries, Commercial Fisheries, Shellfish Purification Plant, and Reimbursements to Cities and Towns.

The Division received $354,550 in federal reimbursements under the Commercial Fisheries Research and Development Act and the Anadromous Fisheries Restoration Act. An additional $216,234 was received in federal grants, and $277,395 in non-federal trusts.

License sales were up during 1978. Revenue increased by $27,000. A total of $454,342 was received from the sale of 16,719 licenses.

	Commercial Fisherman Permit	Number Issued
	Coastal Lobster	1,368
	Offshore Lobster	414
	100-ft. Boat	44
	60 - 99 ft. Boat	111
	Under 60-ft. Boat	601
	Seasonal Lobster	192
	Individual	439
	Shellfish	1,531
	Rod and Reel	522
	Shellfish, Rod and Reel	114
	Duplicates	39
	TOTAL	5,375
B.	Dealer Permit	
	Wholesale	429
	Retail	820
	Retail Truck	10
	Bait	78
	Duplicates	9
	TOTAL	1,346
C.	Special Permit	
	Non-commercial Lobster	8,915
	Regulated Fishery	143
	Master Digger	20
	Subordinate Digger	199
	Bait	555
	Other Special Permits	80
	Duplicates	86
	TOTAL	9,998
	TOTAL ISSUED	16,719

Cat Cove Marine Laboratory

Analyses for polychlorinated biphenyls and pesticides in lobsters, bluefish and striped bass were conducted. In addition, samples from a PCB (polychlorinated biphenyls) spill at the Lynn General Electric Plant and osprey eggs from the Westport River area which exhibited thinning of their shells were analyzed.

A study of the effects of short-chain hydrocarbons on the respiration of shellfish continued. A new study using methodology developed by the laboratory was initiated to measure pumping rates of shellfish under a variety of conditions. John Miller, a student intern from the University of Massachusetts, was assigned to this project.

An extensive survey of Gloucester--Annisquam River, Essex Bay and Ipswich Bay was undertaken with the cooperation of Dr. Dean Anderson of the Woods Hole Oceanography Institute and the M.I.T. Sea Grant Program with respect to *Gonyaulax tamarensis* cysts. The presence of large numbers of cysts could provide seed populations for potential paralytic shellfish poisoning (PSP) blooms under favorable oceanographic conditions, and their localization might prove useful as a predictor of the extent and locations of future blooms. The results from this study were negative in contrast to Dr. Anderson's experience at several locations in the Cape Cod area.

Cultures of *G. tamarensis* were maintained in the laboratory and were provided to investigators at Harvard University, University of Massachusetts and Boston State College, and a number of high school teachers for demonstration purposes.

A study of the long-term depuration of *G. tamarensis* toxin in the sea clam, *Spisula solidissima* was conducted. This species of clam appears to bind the toxin more tightly than other shellfish. The half-life of the toxin appears to be in excess of one year.

Seawater from the Newburyport Shellfish Depuration Plant was monitored for presence of *G. tamarensis* during the period when blooms on the North Shore forced the closing of clam beds.

Twenty-five hundred juvenile striped bass were received and maintained at the laboratory. Except for the loss of a large number in the pool due to a netting failure, mortality was low. Seawater parameters were monitored in conjunction with this project.

The laboratory participated in the interlaboratory quality control pesticide program sponsored by the Federal Food and Drug Administration.

Tours of the laboratory and presentations at High School

Career Days continued. The Division exhibited at the annual Essex Agricultural School field days.

Assistance was provided to the Shellfish Depuration Plant during employee vacation/sick leaves. Personnel assisted the Division of Personnel, Civil Service, in development of specifications for the positions of Laboratory Technician, Assistant Marine Fisheries Biologist, Marine Fisheries Biologist and Senior Marine Fisheries Biologist.

Laboratory personnel developed a program for an "Investigation of the Feasibility of Shellfish Depuration on the South Shore." A contract was subsequently awarded to Marine Research, Inc., of Falmouth.

Laboratory personnel worked with D.E.Q.E. personnel to develop a grant proposal for a cohesive study of the complete shellfish depuration potential in Massachusetts.

The laboratory acquired a newer liquid scintillation counter to replace the unit which was reappropriated by the New England Power Company. A Cahn electrobalance and a fluorescence conversion unit for microscope use were also obtained. Installation of a new fume hood and repair of the incubator units required outside service. A new ceiling was installed in one of the laboratories and ducts were installed to provide air conditioning to a second. A new storage shed was built, a leaky roof repaired and a defective thermal pane replaced. The seawater pumps were overhauled and the outdoor lighting system was repaired. Corroded gas lines in two of the laboratories were replaced. The parking lot was prepared for resurfacing.

Area Management Teams

North Shore Area Team

The feasibility of opening certain areas in Ipswich Bay to a mobile gear fishery was investigated. The territorial waters of Ipswich Bay have been closed for many years because of a gear conflict problem between fixed and mobile gear fishermen. Extensive field sampling revealed that fixed gear was virtually absent from the Bay during the late fall and winter months and that a sufficient resource existed to provide a fishery for small draggers. Following a public hearing held in Gloucester at which the area team presented its field data and recommendations, a change in regulations was promulgated to provide for a seasonal mobile gear fishery in Ipswich Bay. The resulting fishery that took place provided a means of earning income for approximately 20 small draggers from Gloucester and Newburyport that would not have been able to fish at all due to harsh weather and vessel size. No gear conflict problems resulted from this fishery.

Project personnel assisted National Marine Fisheries Service in conducting mesh trial studies on Georges Bank. Seven sea sampling days were spent to determine an optimum mesh size for the offshore ground fishery.

The area team has been very actively involved with the Merrimack River Anadromous Fisheries Restoration Project. This program is a joint effort in cooperation with National Marine Fisheries Service, New Hampshire Fish and Game, Massachusetts Fish and Wildlife, U.S. Fish and Wildlife Service and the Massachusetts Division of Marine Fisheries.

Team personnel conducted extensive gill netting operations in an effort to document the presence of sturgeon in the lower River system. Although no sturgeon were captured employing gill netting techniques, visual observations documents the presence of Atlantic sturgeon. Shortnose sturgeon (presently an endangered species) may be present in the Merrimack and additional sampling should be conducted prior to drawing conclusions on their presence or absence.

The area team coordinated the operation of a salmon trap set in the River to capture returning adult Atlantic salmon. Returns were expected this spring resulting from the stocking of salmon smolts in 1977. The trap did not capture any live adult salmon used in the brood stock development program, however, two sportfishery Atlantic salmon catches were documented. Project personnel assisted in the stocking of 21,000

smolts this spring.

An Atlantic salmon scale reading workshop was hosted by the team and held at Cat Cove Marine Laboratory. The workshop was quite successful and well attended by state and federal biologists from Massachusetts, New Hampshire and Vermont.

Project personnel designed and initiated a project to determine the extent and distribution of the microsporidian *Glugea hertwigi* and piscine erythrocytic necrosis (PEN) in Massachusetts coastal smelt populations. Samples of smelt from six coastal streams have been collected and are currently being analyzed. Age structure of individual smelt runs is also being examined. This work is being conducted to determine if a correlation might possibly exist between the presence of disease and parasites to the abundance of smelt.

Smelt eggs were stocked in two coastal streams in Ipswich: Bull Brook and the Ipswich River. Twenty-five egg trays were placed in each stream in an effort to reestablish self-sustaining smelt populations.

Team biologists cleaned all the Parker River fishways prior to the spring alewife run. The wooden denil ladder at Pentucket Pond in Georgetown had been virtually destroyed by ice and vandals. This ladder was rebuilt and reinstalled by team personnel.

Routine fish kill investigations were conducted to determine the cause and extent of mass menhaden mortalities in the Charles River, Neponset River, Monataquoit River, Weymouth Fore River, Lynn and Boston Harbors. Low dissolved oxygen levels accounted for the bulk of the mortality. Team biologists have been working with University of Rhode Island fish pathologists in collecting menhaden specimens for brain cultures. Cultures from previous menhaden kills have indicated a possible link between mass menhaden mortalities and a *Vibrio* spp. infection. Research should continue to solve the complex problem of mass menhaden mortalities.

Technical assistance has been provided to many North Shore communities in matters pertaining to shellfish. Aid to towns was given in various forms from sampling flats to developing management plans. Specific projects included:

Gloucester--lending technical assistance for sampling of potential harvesting areas.

Quincy--As an agent of the Division, attended town meeting dealing with problems of landings sites and why action has not been taken to retest areas of potential harvest.

Hull--Attempted to develop Hull management plan; attempted

to coordinate sampling of surf clam population among the Division, the Department of Environmental Quality Engineering and town officials.

Dorchester--Development of management plan by the Division and supervision of implementation of said plan.

A sampling program to determine the distribution of *Gonyaulax tamarensis* cysts in the Cape Ann--Ipswich Bay was conducted in cooperation with the Cat Cove Laboratory staff. This program was designed to locate concentrations of cysts assumed to be the parent stock of major PSP outbreaks in North Shore waters. No major concentrations of *Gonyaulax tamarensis* cysts have been located as yet.

South Shore Area Team

A shellfish population study was conducted in Duxbury. Populations of clams were low and contained a high proportion of sub-legals. It was recommended that the fishery remain closed until 1980 and that the town institute a program for predator control.

A preliminary study on the feasibility of a pot fishery for scup in Buzzards Bay was completed. Work resulted in an improved pot design and fishing methodology. The study will continue during Fiscal 1980 to determine if this type of fishery is economically feasible and should be promoted.

A study of alewife movement in the Monument River was completed. Data indicated that upstream migration takes place almost exclusively during daylight hours. There appeared to be a positive correlation between light intensity and the number of fish passing through the fishway. The Monument River alewife migration patterns appear to fit the model developed by the University of Massachusetts on the Parker River.

Length-frequency data on sea herring landed in Sandwich were compiled. This information was made available for use in formulating the state's sea herring management plan.

In an attempt to diminish gear conflicts, charts indicating positions of fixed gear were given to the herring pair trawlers. This apparently had a positive effect, as reported gear conflicts for 1979 were 90% less than those reported in 1978.

Smelt were collected for two studies. Smelt in the Assonet, Jones and Weweantic Rivers were sampled for the occurrence of Piscine Erythrocytic Necrosis and *Glugea hertwigi*. In the Jones River the smelt spawning population was investigated. Length-

frequency, sex ratio, relative number and egg density data were obtained.

Four fish kills were investigated during the year. Juvenile menhaden were killed in Muddy Cove, Wareham due to a 2,000 gallon spill of ferrous sulphate. Later in the year adult herring were killed in the same area because of an ammonia spill. A cause was not determined for a menhaden kill in the Acushnet River. Squid *(Ilex)* strandings occurred in Buzzards Bay from Onset to Marion. It was felt that this was not pollution-related.

Displays were prepared and fisheries information was presented at three public exhibitions: Seafair 78--New Bedford; Sea Harvest--Plymouth; and Fish Expo--Boston.

Cape and Islands Area Team

Area Team personnel increased their efforts to acquire more knowledge of the fisheries within their area; this was accomplished by more frequent trips aboard various fishing craft and increased contact with fishermen and fishing organizations and local authorities. Technical assistance was given to the Town of Sandwich in their pursuit to increase the size of the Sandwich Boat Basin, the result of which would provide more space for the commercial fleet. We collected and compiled data on the current composition of the Sandwich fleet and annual harvest and advised the selectmen relative to the needed facilities for an expanded fleet. A second major effort was a survey of charter and party boats around Cape Cod. Personal interviews and a questionnaire survey was completed. Data on trips, catch, and expenses will provide an important information on the value of this industry to Cape Cod.

Shellfish technical assistance to local towns and fishermen continued. The major thrust of the assistance was shellfish culture harvesting and municipal management. Considerable assistance was given to Nantucket as they successfully obtained a CETA grant to help them improve their town shellfish management and quahog culture programs. An assistant biologist was assigned to the town to advise on the direction and progress of these projects. The Third Quahog Culture Conference, organized by this Area Team leader, was a success as over 70 people attended--some from Canada. A report on a trailerable shellfish harvester was completed and published. This report sums the results of a contract with a shellfisherman from Edgartown, who developed a small boat hydraulic clam harvester.

Monitoring continued on the tire reef in Nantucket Sound. Initial concern about the scattering of tire units by winter

storms were not founded; the units are intact and stable. An evaluation of reef stability and vertebrate/invertebrate colonization will require several more years of monitoring.

Two contracts drafted by this project were approved. One concerned fish quality on small fishing vessels. Fish boxes were provided via this funding as a means to reduce handling of fish onboard and increase the quality of the product by keeping the fish covered and cool. A Chatham fish company is cooperating by encouraging the use of these boxes on several commercial boats. The fish company will also monitor quality both by temperature and visual inspection. A second contract to experimentally fish for squid *(Loligo)* using artificial lights was just completed. The purpose of the contract was to determine the feasibility of this technique on concentrated squid populations in Nantucket Sound. We anticipate a published report on this experiment.

Fishery Resource Assessment

In 1978 the Division of Marine Fisheries became the first Atlantic coast state agency to undertake a statewide inshore bottom trawl survey program. Its purpose was to develop a data base for more effective fisheries management policies. The Massachusetts survey is unique because it has been conducted from a chartered fishing vessel and yet it follows normal scientific procedures. Trawl stations are proportionally allocated according to depth strata area and geographically distributed throughout the survey region. Only trawlable bottom is sampled. Standardized trawl gear and fishing methods are employed and a complete record of each species catch weight and length is maintained.

An autumn (#002) and spring (#003) cruise were undertaken aboard the F/V FRANCIS ELIZABETH during the 1979 fiscal year. Cruise efforts and results are summarized as follows:

	Cruise #002	Cruise #003
Vessel hrs.	206.5	229.0
Sampling days	21	19
Stations completed	95	100
Stations aborted	15	17
Net repair man-hrs. at sea	15	15
DMF participants	14	21
Scientific man-hrs. at sea	609	618
Total catch weight (kg.)	33,757	17,056.7
Total catch number	308,237	74,403
Age, growth and maturity samples	546	865
Age and growth specimens	479	434
Food habit specimens	583	331
Pathobiological observations	-	3,324

Fish samples obtained for age, growth, maturity, food habits and pathobiology studies are processed directly by the National Marine Fisheries Service with results contributing to updated species assessments. The computerization of voluminous catch records has been undertaken by project personnel, a time-consuming task that has posed many problems in both personnel training and software adaptation. Data listings are complete, however, an alteration to program design has delayed initial data analysis output.

Project leader Arnold Howe co-authored a paper with G. T. Waring on the "Occurrence of young of the year Atlantic herring in Southern Massachusetts estuaries in summer of 1978." The paper appeared in Coastal Oceanography and Climatology News.

Cod Aging Project

On October 1, 1978, the Division of Marine Fisheries entered into a contract with the National Marine Fisheries Service, Woods Hole, to age cod from survey cruises of the ALBATROSS IV and DELAWARE II and the backlog samples from commercial vessels. Methodology and procedures were learned at the Age and Growth section of the National Marine Fisheries Service, Woods Hole, and equipment was purchased to allow personnel to age cod by preparing the otoliths at the Division's field station in Sandwich.

A total of 2,152 cod otoliths were baked, aged, re-aged and put on summary and tally sheets.

In addition, project personnel assisted in the Division's Resource Assessment 1979 spring trawl survey, and aided National Marine Fisheries Service personnel with the haddock scale computer project.

Coastal Lobster Investigations

A management plan for the Massachusetts inshore lobster fishery was completed and submitted for administrative review. The plan describes the history of exploitation and management, summarizes available biological and economic information, and proposes a system of scientific management regulations. A plan for the management of the U.S. lobster fishery, prepared under the auspices of the Northeast Marine Fisheries Board, was presented to industry representatives and the public.

A tagging study, designed to augment existing growth information and investigate the migratory behavior of lobsters inhabiting the Cape Cod Canal, was initiated in April. A total of 351 lobsters had been tagged and released by the end of the

fiscal year, with up to 1,000 total releases planned. Tag return data from past Division studies have been combined and re-coded for computer analysis.

The stocking of 505,000 hatchery reared fourth stage lobster larvae was coordinated between hatchery and Area Team personnel. Stocking sites and practices have been evaluated, and initial survival maximized at all sites.

The project continues to maintain close contact with organized lobstermen through attendance at scheduled meetings. The question of limited entry into the coastal lobster fishery has been the main topic of discussion, with various proposals and plans discussed at length.

Lobster Hatchery and Research Station

Hatchery and area team personnel continue efforts to compare survival rate of lobsters released from the hatchery. Stockings were monitored by divers and those larvae released in areas with eel grass and an abundance of vegetative cover had higher initial survivals. A total of 605,000 lobster were released this year.

The hatchery continues to evaluate culture techniques, selective breeding and nutritional studies and developmental methodology leading toward aquaculture.

Salem Harbor Power Plant Project

The marine environmental impact study of the Salem Harbor Electric Generating Station was essentially completed during this fiscal year. Adult and juvenile finfish population studies confirmed the basic findings of earlier studies--that fluctuations in catch per unit effort and the Shannon-Weaver index, were naturally occurring phenomenon and not related to power plant operation. This was further confirmed by statistical evaluation of the relative abundance of all finfish taken during the study, which showed no significant change in the dominance relationships of the indigenous fish populations in Salem Harbor.

Studies of two eelgrass *(Zostera marina)* beds in the area documented expected seasonal life cycle changes and showed that the eelgrass in the harbor was healthy and viable. Power plant operation created no apparent adverse effects on the eelgrass in the area.

Weekly 24-hour finfish impingement monitoring showed that total fish impingement on the traveling screens at the plant's

intake units 3 and 4 was similar for the sampling years 4/77 - 3/78 and 4/78 - 3/79, 23,489 vs. 23,156. These numbers were considerably lower than those estimated from quarterly studies in 1975 (39,578 fish per year). In 1975 it was felt that the higher number of fish impingement was not detrimental to the finfish populations. Therefore, the lower numbers found during more intensive sampling certainly support the earlier contention that finfish impingement does not create a problem at the Salem Harbor Power Plant.

Laboratory processing and data analysis of all ichthyoplankton samples collected from March 1975 through February 1977 was completed. The most abundant egg species taken were cunner, fourbeard rockling, yellowtail flounder, red hake and windowpane. Major larval species included sand lance, cunner, winter flounder, radiated shanny and grubby. Basically, the data showed that eggs and larvae were more abundant at the deeper offshore waters, rather than at the stations located within Salem Harbor itself. Egg and larval densities at the power plant's intake were similar to the other inner harbor stations during the first year of sampling. However, during the second year, ichthyoplankton densities at the intake were the lowest of any station sampled. This leads to the conclusion that the power plant intake is probably situated at a good location in Salem Harbor in terms of minimizing ichthyoplankton entrainment.

A limited entrainment induced mortality study was conducted in the plant's discharge canal. This study showed that some fish eggs did survive entrainment in the plant's cooling system. Due to our inability to take a comparative intake (control) sample, no absolute value could be placed on the survival percentage.

Although not required by the contract, work began on two publications which would be major contributions in the general study of ichthyoplankton. The first is an annotated bibliography of the ichthyoplankton of Massachusetts Bay and the second is a laboratory manual which is designed to aid in the identification of 46 species of ichthyoplankton which are found in Massachusetts Bay.

Pilgrim Power Plant Study

Fishery Investigation Program

Four studies are continuing to obtain information on occurrence, distribution, behavior, relative abundance, and population structure of important commercial and recreational finfish in the vicinity of the Pilgrim Nuclear Power Station. We also investigated several fish kills at the plant during this reporting period.

From field observations, we documented an illegal discharge of detergent chemicals into the Jones River, and with the cooperation of the Division of Water Pollution Control are pursuing, through the State's Attorney General's office, a remedy to this situation.

Fish Kills

Three separate finfish mortalities occurred at Pilgrim Nuclear Power Station between 21 August and 29 December, 1978. An invertebrate and algal kill also occurred and was apparently linked in cause to one of the finfish mortalities. From an investigation of each incident, we quantified mortality, assessed impact to respective populations or community structure, and endeavored to determine cause. These findings were reported to all Advisory/Technical members and regulatory agencies and later published by Boston Edison Company in a report entitled "Marine Ecology Studies Related to Operation of Pilgrim Station" (Report No. 13).

Recommendations

As a result of smelt mortality and prior impingement incidents, the Division of Marine Fisheries recommended to the regulatory agencies and Boston Edison Company that the existing Unit I sluiceway be modified to provide direct return access of impinged fish to ambient water sufficiently distant from the intake structure to avoid reimpingement. We also recommended that intake screens be rotated continuously during impingement problems to reduce exposure time. These recommendations were endorsed by a majority of the Advisory/Technical members, by the Environmental Protection Agency, and by the Division of Water Pollution Control. The Environmental Protection Agency and Division of Water Pollution Control subsequently mandated Boston Edison Company to initiate construction and modifications of the existing sluiceway, as soon as possible, pursuant to plans submitted by the power company and agreed upon by the regulators.

Lobster Investigation Program

Our lobster pot study continued with cooperating lobstermen to obtain a measure of their success throughout the fishing season in our study area as an index of total harvest. In 1978, we sampled 2,432 lobster pots increasing our data base to more comprehensively assess plant impact on the local lobster population.

Irish Moss Program

Collection of landing statistics on Irish Moss harvested in the environs of the plant indicated that total landings declined from 1977 to 1978 both at the surveillance (47%) and reference (20%) areas.

Dissolved Gas Analyses Program

Because of past fish mortalities and potential future occurrence of gas bubble disease problems at Pilgrim Nuclear Power Station, we continued collecting measurements of dissolved gas content of intake and discharge waters under varying plant operation levels.

Radiological Sampling Program

In 1979, we commenced to collect marine life and sediment samples for Boston Edison Company's radiological analysis program.

Report Preparations

We completed two semi-annual reports on our studies at the plant which were published by Boston Edison Company. The project leader co-authored a paper entitled "Methods for Preventing Gas Bubble Disease Mortality of Atlantic Menhaden at a Coastal Nuclear Power Plant". This paper, submitted for review and consideration for a Special Session of the Transactions of the American Fisheries Society, received a favorable response from the initial review process and was recommended for publication to the editor. An article written by the project leader entitled "Marine Sportfishing at a Nuclear Power Plant" was accepted for publication by Massachusetts Wildlife and appeared in the May - June, 1979 issue.

Cape Cod Canal Power Plant Study

The Cape Cod Canal Study completed its final year of field studies and started preparation of a final report during Fiscal 1979. Major objectives of the study which dealt with the determination of the effects of a fossil-fueled power plant on the marine environment in the vicinity of the Cape Cod Canal were completed.

Four hundred fifty-nine neuston tows were made in northern Buzzards Bay, Cape Cod Canal and Cape Cod Bay. A total of 9,631 lobster larvae were collected. The numbers per 1,000 cubic

meters obtained on several occasions far exceeded densities obtained elsewhere on the east coast.

Six hundred eighty fish egg and larvae samples were collected and analyzed. A total of 1,158,422 fish eggs and 167,118 fish larvae comprising 47 species were separated from the samples. The cunner-tautog-yellowtail flounder egg group made up 62.8% of all the eggs collected with cunner and tautog larvae comprising 54.2% of all the larvae. One interesting observation was that sand lance larvae comprised 23.5% of the larvae collected. Large numbers of these fish were evident along the coast this spring.

Fishery Economist

A number of reports and reviews were written during the course of the year. These were "A Review of the Draft Lobster Management Plan", "A Review of the Stock-certificate Management Proposal for New England Groundfish", "A Review of the 'Economic Impact of the Atlantic Bluefin Tuna Fishery in Massachusetts'", "Changes in Harvesting Patterns in Massachusetts Lobster Fishery 1973 - 75", "Economic Impacts of the Massachusetts Lobster Licensing Moratorium", "A Statistical Profile of the New England Groundfish Processing Industry", "An Analysis of the U.S.--Canadian Fisheries Agreement Provisions for Massachusetts Fisheries for Underutilized Species", "Estimators of Annual By-catch Ratios for Cod and Haddock" and an analysis of "A Proposal to Develop the New Port of Lynn Marine Industrial Park".

Other activities included assistance to the New England Fisheries Management Council staff in compiling data for the Demersal Finfish FMP, participation in the Federal--State Statistical Committee, and assistance to the Town of Nantucket's project for fisheries development.

Anadromous Fisheries Management

The Division continued efforts to restore, enhance and manage anadromous fish populations in coastal streams and rivers of the Commonwealth.

A 200' ± denil fishway was constructed on the Agawam River, Wareham. The new facility overcomes an elevation difference of 10' ± and allows improved access to Glen Charlie Pond (163 acres). It is constructed of 3,000 lb. reinforced concrete and includes a 16' resting pool, a 36' road culvert and two 36' denil sections.

In Mashpee a 30' long, 5' wide and 4' high weir pool ladder was constructed in order to improve access to the road culvert beneath Route 130. It contains five pools and is constructed of air entrained, 3,000 lb. reinforced concrete.

Also in Mashpee a 24' long wooden denil ladder was installed at Santuit Pond (160 acres). This ladder replaces a deteriorated, wooden, weir pool ladder.

A total of 27,000 adult alewives were stocked in the following ponds to either establish new runs or enhance spawning stocks in existing runs.

1979 Stocking List

Weeks Pond, Falmouth	1,900
Wings Pond, Falmouth	2,900
Dam Pond, Falmouth	-----
Cedar Lake, Falmouth	1,000
Mill Pond, Falmouth	1,200
Johns Pond, Mashpee	1,200
Shawme Pond, Sandwich	1,950
Tispaquin Pond, Middleboro	1,200
Island Creek Pond, Duxbury	1,200
Foundry Pond, Hingham	1,200
Lilly Pond, Cohasset	1,500
Leonards Pond, Rochester	1,200
Lake Nippenicket, Bridgewater	1,200
Lilly Pond, Gloucester	1,000
Bass River Club Pond	1,200
Yarmouth Golf Club	1,100
Herring Pond, Wellfleet	1,250
Herring Pond, Bourne	1,200
Red Brook, Bourne	1,200
Lagoon Pond, Martha's Vineyard	2,400
Total	27,000

Collecting trays (185) were again used to collect smelt eggs in the Jones River, Kingston. Approximately 15,000,000 eggs were transplanted to the Sandwich Creek, Sandwich and 5,000,000 to Bull Brook, Rowley. Eleven hundred adult smelt were also moved from the Jones River to the Coonamessett River, Falmouth.

Efforts continued to re-establish shad in four Massachusetts Rivers through the stocking of pre-spawning adults. A total of 1,034 shad were transplanted from the Connecticut River to the Charles River, 844 to the Taunton and Nemasket Rivers and 359 to the Merrimack River. As part of a cooperative effort with other New England states, an additional 400 shad were transported upstream in the Connecticut River from Holyoke, Massachusetts to Vernon, Vermont.

Coho Salmon Introductions

Work also continued on the experimental coho salmon program.

Adults of the 1976 year-class returned to the Indianhead River in the fall of 1978. Eighteen adults (10 females and 8 males) were recaptured in the river and seven sportfish catches were recorded. These, in combination with two precocious males taken in 1977, made a total return of 27 fish for a return rate of 0.59% of the 4,575 cohos stocked. This year-class was an F_2 generation and provided 24,836 eggs to comprise the 1979 year-class and the program's first F_3 generation.

Hatching success for the 1979 year class was 78.5%. Initial fry mortality was high due to difficulties in switching the salmon from macerated liver to dry diet. The juveniles were placed in Ewos circular rearing pools and appear to do well in this type of system. As of June 30, the 1979 year-class inventory was 14,907 fingerlings.

The 1978 year-class was stocked in the Indianhead River on April 4 - 11, 1979. A total of 46,436 pre-smolts and smolts were released in the impoundment at Elm Street. Average size was 14.9/lb. A group of exceptionally large smolts which averaged 4/lb. and numbered 1,756 were given right pelvic fin clips to determine any difference in return rates between these and smaller parr. The salmon remained in the North River system for approximately two months, leaving in early June.

The federal aid application submitted by this agency and the Director of Fisheries and Wildlife to renovate the East Sandwich Fish Hatchery as an anadromous fish hatching and rearing station has been approved for 50% federal funding under the Anadromous Fish Conservation Act, P.L. 89-304. Contracts for site preparation and rearing pool construction have been

awarded and construction is expected to start in early July, 1979. Once operational, the hatchery will facilitate rearing and stocking of approximately 100,000 coho salmon smolts annually as a means of evaluating the potential of a hatchery-supported coho salmon fishery in Massachusetts.

Striped Bass Management

The State/Federal Striped Bass Management Program implemented last year by the coastal states from Maine through North Carolina proceeded toward development of a management plan. The program's goal is perpetration of the striped bass resource in fishable abundance throughout its range generating the greatest possible net economic and social benefits from its harvest and utilization over time. Given the wide range of interests associated with this species and the face that much remains unknown about its population dynamics, developing and implementing a set of management measures that will fulfill program objectives in a timely fashion promises to be a formidable task.

Merrimack and Connecticut Rivers Anadromous Fisheries Restoration Program

Cooperative programs with other New England states to restore Atlantic salmon and American shad to the Connecticut and Merrimack Rivers made substantial gains during the year. Most noteworthy has been the progress relative to development of fish passage at major dams on both systems. Construction of a multimillion dollar fishway at Turners Falls on the Connecticut River commenced this year and work on a fish elevator at the Essex Dam in Lawrence on the Merrimack River is scheduled to begin in 1980.

Cooperative Fishery Unit

The Division continued to provide technical and financial assistance to the Cooperative Fishery Unit at the University of Massachusetts, Amherst. Supported jointly with the U.S. Fish and Wildlife Service and the Division of Fisheries and Wildlife, the Unit trains graduate students in the field of fishery science and conducts basic research of value to supporting agencies.

Information/Education

A report entitled Experimental Introduction of Coho Salmon to Massachusetts Coastal Waters, December 1969 - June 30, 1979,

was prepared and printed in limited numbers.

Anadromous Fish of Massachusetts, a booklet summarizing the regulations, management and utilization of shad, smelt, and alewives in Massachusetts was updated and reprinted.

Both publications are available to the public upon request.

BUREAU OF COMMERCIAL FISHERIES

Massachusetts commercial landings of fish and shellfish in 1978 exceeded 376 million pounds worth over $152 million in ex-vessel value to the Commonwealth's fishermen. These landings represent an increase over 1977 levels of 18% in weight and 34% in landed value. Massachusetts ranked fourth nationwide in terms of landed value behind Alaska, California and Louisiana.

New Bedford maintained its position of fifth among U.S. ports with total landings of over 72 million pounds of fish and shellfish worth over $54 million landed value. Sea scallops continue to dominate the New Bedford catch, accounting for 56% of the landed value, followed by yellowtail flounder, cod and blackback flounder.

Gloucester landings increased by 23% over 1977, elevating it to sixth position nationwide in terms of landed weight and tenth in terms of landed value, with over 185 million pounds worth over $28.9 million.

The Massachusetts commercial lobster catch increased to 6.7 million pounds in 1978, an increase of 1.3 million pounds over 1977. The coastal lobster fishery continues to be the Commonwealth's most valuable inshore fishery with a 1978 ex-vessel value of $12.7 million.

During F.Y. 1979, the Division continued and expanded programs designed to assist and promote the Massachusetts commercial fishing and seafood industry. Partial funding for these programs was provided by the Federal Government under P.L. 88-309, the commercial fisheries Research and Development Act.

Commercial Fisheries Extension Service

The Massachusetts Commercial Fisheries Extension Program completed its fifth year of service to the Commonwealth's fishing industry, utilizing fishermen as expert advisors. The addition of a full-time coordinator has improved overall communication and coordination of services while the acquisition of vans for the three extension agents greatly increased their mobility and visibility.

Each of the agents has special areas of expertise, along with personal experience in the fisheries of his area of coverage (North Shore, South Shore, Cape and Islands). This diverse fund of expertise is pooled and coordinated as necessary to meet the needs of each area's fishermen. An effective level of communication has developed in each port as fishermen become more aware

of the program. The agents personally disseminate and collect information, provide technical assistance as required, and generally have become the first line of communication between fishermen and the various levels of government.

The agents participated in many formal and informal demonstrations, workshops and forums during the year, including the development of the Cape and Islands Fishermen's Forum by the Cape and Islands Agent, and the two bottom trawl workshops taught by the South Shore Agent at the Massachusetts Maritime Academy. Various types of gear were demonstrated including trammel nets and an outboard-powered hauler currently used in the British Isles. The agents also assisted Division projects and other agencies in the collection of statistics, fuel allocation needs, field sampling, and the identification of area needs and priorities.

Fisheries Marketing Program

With the addition of a full-time Marketing Coordinator for the Marketing Program in February, the transition from a contractual to an in-house operation was completed. Program activities were primarily developmental in nature, examining the structure of the Massachusetts Seafood Council, planning the direction of the new program, and acquiring the equipment necessary for promotional activities.

The coordinator participated in the National Fisheries Development Conference in Washington, addressed the Massachusetts Marine Educators and the Cape Cod Seafest Banquet, and conducted a mussel cooking demonstration at the Plymouth Fishermen's Festival.

The distribution of promotional literature, marketing kits, and recipe books to dealers and the public continued, utilizing the services of a storage and shipping company.

Commercial Fisheries Statistics

The increasing demand for reliable landings data for Massachusetts commercial fisheries resulted in a comprehensive in-house review of current methodology and statistical needs for management purposes. In addition, the project leader served on a State/Federal Statistical--Technical Committee established to assess statistical needs at the regional level.

Due to the lack of space in the Boston office, the Statistics Project was moved to the Division's Cat Cove Marine Laboratory in Salem. No major problems have occurred in the overall operation of the project as a result of this move.

Annual catch reports were collected from all licensed commercial and recreational lobster fishermen for 1978. These data will be utilized in an annual publication entitled Massachusetts Coastal Lobster Statistics, and included in the annual Fisheries of the United States by the National Marine Fisheries Service.

Annual catch reports were collected from commercial shellfishermen and shellfish constables, fish trap operators, and commercial draggers operating in the North Shore Mobile Gear Area. Project personnel continued to collect and compile transaction slips from licensed seafood dealers for inclusion in Massachusetts Landings.

Project personnel responded to numerous requests for landings information from various governmental agencies, academic institutions, consulting firms, and the general public.

1978 Lobster Statistics*

License Type	Number Issued	Number Fishing	Number Not Fishing	Pounds Landed	Value	Pots Fishing
Coastal	1,368	1,269	59	6,692,188	$12,676,726	237,547
Offshore	414	118	217	1,897,753	3,836,048	18,740
Seasonal	192	155	27	37,557	71,719	2,949
Non-commercial	8,915	4,212	3,196	298,853		16,962

*Based on annual catch reports from fishermen.

1978 Shellfish Statistics
Based on Reports from Local Constable

Permits issued by Cities and Towns

Resident Family	31,254
Non-Resident	3,995
Other	2,973
Commercial	3,621

Harvest in Bushels*

Species	Family	Commercial	Private Grants
Quahog	35,330	68,937	18,010
Soft-shell clam	17,344	39,354	10
Oyster	2,948	2,030	9,864**
Bay scallop	16,747	280,582	198
Sea scallop	----	496,088 (lbs.)	
Razor clam	467	255	
Surf clam	1,844	12,495	
Mussel	897	14,415	
Conch	110	13,849	
Eels	6,643 (lbs.)	101,558 (lbs.)	

*Unless otherwise indicated
**Bushels sold as seed to other towns

Shellfish Technical Assistance

This program provides technical assistance relating to shellfish culture, management, and harvesting to coastal communities, governmental agencies, and individuals. During FY-78 a total of 230 requests for assistance were answered: 123 to cities and towns; 87 to agencies; and 20 to individuals.

Local shellfish projects for FY-79 were evaluated, and reimbursements totalling $249,999.52 were recommended. This represents a 33.18% reimbursement to the 50 cities and towns with local appropriations for shellfish management. Reimbursement of up to 50% of municipal shellfish management expenditures is authorized under Section 20A of Chapter 130, M.G.L. (Chapter 571, Acts of 1974).

Assistance was given to eight communities in the development of management plans for local control of moderately contaminated shellfish, established under Chapter 447, Acts of 1977. Project personnel continued to participate in the management of moderately

contaminated areas under state control, with major efforts at Carson Beach, Boston, and Governor's Island, Winthrop. In addition, a management plan for the overall management of the moderately contaminated softshell clam resource was prepared and approved. The Plan describes objectives, policies, procedures, and guidelines for state and municipal management of moderately contaminated areas.

A total of 26 shellfish resource surveys were conducted in a coordinated effort by the Shellfish Project and the Area Resource Teams.

The cooperative oyster growth project with the Town of Falmouth, utilizing Pacific oysters *(Crassostrea gigas)* grown on rafts, was completed, and a paper entitled "Culture of the Pacific Oyster, *Crassostrea gigas*, in Massachusetts Waters" was delivered at a workshop on the biological and legal aspects of the introduction of exotic species for marine mariculture at the Woods Hole Oceanographic Institution.

Major oyster areas were monitored and examined for the presence of the pathogens *Minchinia costalis* and *Minchinia nelsoni*, and the state's policy regarding oyster transplants was re-evaluated. A major change allows the transplanting of oysters infected with *M. costalis* into other infected areas, since this organism is considered endemic throughout the Northeast by the National Marine Fisheries Service.

Shellfish Purification Plant

On September 27, 1978, the Commonwealth assumed full fiscal responsibility for the operation of the Shellfish Depuration Plant at Newburyport. Prior to this date, each community using the services of the Plant paid a portion of the annual deficit in proportion to its percentage of total use. During the period January 1 through September 26, 1978, six towns shared a deficit of $27,996.99.

The total volume processed during calendar year 1978 was 14,012 bushels of softshell clams. Fees collected ($3.00/bushel) totalled $42,036.00. The per bushel fees are collected from Master Diggers licensed to harvest moderately contaminated clams.

Repairs to the seawater intake system were completed in July, eliminating the need for costly annual repairs and maintenance; a new fresh water storage tank was installed; a new well dug to provide fresh water for the laboratory; a new ultra-violet unit constructed; and the entire first floor repainted.

The Department of Public Health inspected the Plant in September, and determined it to be in good sanitary condition.

Approximately 1,500 raw and treated shellfish samples were tested during FY-79 for bacterial contamination, as well as approximately 600 raw and treated water samples. A total of 25 plant tours were provided for various groups from schools, governmental agencies, industry and the public.